Authority NND 735022

File - Infantry Board RESTRICTED

CONCURRENCE

4 March 1944

CONCURRENCE

REPORT

of

The Infantry Board

No. 1576

GRENADE, RIFLE, WP, T5E1 AND HC, T6E1

FORT BENNING, GEORGIA

6 March 1944

24725—Benning, Ga., 9-16-42—2,000

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R/T #15

RIFLE SMOKE GRENADES (WP) M19 AND (HC) M20

1944-

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PURPOSE: To provide improved smoke grenades which may be fired from the rifle grenade launcher.

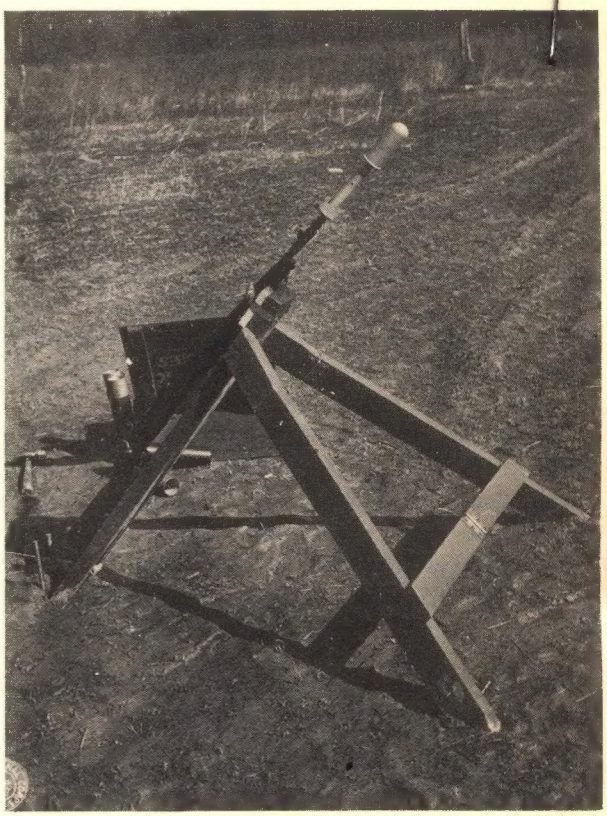
DESCRIPTION: The M19 (WP) Grenade is substantially the same as the T5E1 Grenade. Preliminary reports from the field indicate that the M19 (WP) Grenade is particularly effective both as an antipersonnel weapon and a smoke producing agent. Upon impact the M19 Grenade bursts, producing a shower of phosphorus particles which are reported as being effective for bringing entrenched enemy troops out of their fox holes into the open. The M20 Grenade is slightly superior in smoke producing qualities but has no antipersonnel value. It is expected that use of the M20 Grenade will be limited to special situations whereas a broad field of application for the M19 Grenade is anticipated.

Both the M19 and M20 Grenades are formed with a thin, straight-walled, flat-based body with a hemispherical ogive, and a fuze and stabilizer assembly identical in contour and appearance with that used on the M9A1 Antitank Grenade. The M19 Grenade carries 8.5 ounces of white phosphorus and is equipped with a burster well extending approximately three-fourths of the way into the body. The fuzing mechanism is identical with that used on the antitank grenade except that the booster has been replaced by a burster, consisting of a standard Corps of Engineers' 13½-grain PETN blasting cap. On bursting the burning phosphorus is dispersed over a radius of approximately twenty yards.

The M20 Grenade contains 10.1 ounces of HC burning type smoke mixture which is ignited on impact by a fuze similar to that used in the antitank grenade, but without a booster. Both grenades are packed as complete rounds in individual fiber containers, or in tin containers with propelling cartridges and positioning clips being packaged in a wooden box.

RELATED ITEMS: The following table shows related items and certain characteristics of each:

Type of Grenade	M19	M20	T8E1*	M9A1
Filler (oz)	8.5 WP	10.1 HC	6.4	4.0 HE
Weight of Grenade (oz)	24	24	20	20



Rifle Smoke Grenade M19 (WP). Showing rifle and rack for test firing

Type of Grenade	M19	M20	T8E1*	M9A1
Max Range (yds) (approx) M1 or M1903 Rifle M3 Cartridge	234	234	257	257
M1 or M1903 Rifle M3 and M7 Cartridge	309	309	334	334
M1 Carbine, M6 Cartridge	155	155	184	184
M1 Carbine, M6 and M7 Cartridge	215	215	262	262

*(Colored smoke, limited procurement type).

AVAILABILITY: These grenades will exist in quantity during the 3rd quarter of 1944.

BASIS OF DISTRIBUTION: A day of supply of 0.125 rounds per weapon per day has been approved for the M19. The M20 will be used only for special purposes on direction of the T of Opns Comdr.

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474/101 (R) (24 Mar 1944)
GNRQT-11/75268

24 March 1944

SUBJECT: Grenade, Rifle, WP-T5E1 and HC-T6E1.

TO: Commanding General, Army Service Forces, Attention: Director, Requirements Division, Development Branch.

1. Report of the Infantry Board, No. 1576, 6 March 1944, in duplicate, is inclosed herewith.

2. The Grenade, Rifle, WP-T5E1 is an excellent munition embodying an effective casualty producing, smoke laying, and demoralizing agent in one.

3. The Grenade, Rifle, HC-T6E1 is a single purpose smoke laying agent with slight superiority over the Grenade WP-T5E1 for this purpose only.

4. It is recommended that:

a. The Rifle Grenade, WP-T5E1 be standardized without delay and production expedited.

b. That the day of supply of the Grenade WP-T5E1 be .125 rounds per weapon.

c. That the Grenade HC-T6E1 be given no further consideration for ground forces.

For the COMMANDING GENERAL:

/Stamped/ R. J. DELACROIX
Major, A. G. D.,
Asst. Ground Adj. Gen.

1 Incl. (in dup)
IB Rpt of Test, No. 1576,
dtd 6 March 1944.

FOR RECORD ONLY: GNORD - Lt. Col. L. H. Harrison concurs.
G-4 - Col. C. H. Bryan concurs.
This Copy For: Pres., IB.

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IB-471.6

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6 MAR 1944

SUBJECT: Grenade, Rifle, WP, T5E1 and HC, T6E1.

TO: The Chief, Ground Requirements Section Army Ground Forces, Army War College, Washington, D. C.

1. Authority and Purpose:

a. The specific directive for test of the subject rifle grenades, T5E1-WP and T6E1 HC, was contained in 2nd Indorsement, Ground Requirements Section, Headquarters Army Ground Forces, dated 4 February 1944, 471.6 (R) (26 Jan 44) GNRQT-11/70094 on letter from the Chief of Ordnance, dated 26 January 1944, O.O. No. 400.112/5747, Subject: "Service Tests of Grenades T5E1, T6E1 and T8E1," (Appendix C.) Of the three types of grenades covered by the above authority, the colored smoke rifle grenade T8E1 is omitted from this report due to delay in receipt of the test material and to the widely different tactical uses of that munition as compared with the WP and HC grenades. A separate report will be rendered on the T8E1 (Colored Smoke) grenade.

b. The purpose of the test was to learn:

(1) Reliability of the fuze.

(2) Stability of the grenade in flight.

(3) Ballistic data.

(4) Casualty effect of the T5E1 WP grenade.

(5) Effectiveness of the two grenades as a screening agent.

(6) Other pertinent information relating to the use of this munition in Infantry operations.

2. Description of Material. a. Both of the subject grenades are in physical characteristics near replicas of the antitank rifle grenade M9A1, the essential difference being in the filling, which is a smoke material instead of a high explosive. The tail assembly and fuze are the same as in the antitank grenade. Variations in the weight and in the external contour of the body are those made necessary by differences in the technique of filling and in the quantity of the filler materials required.

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b. The sheet steel body of the T5E1, WP grenade is filled with white phosphorus, in the center of which is a bursting charge consisting of a standard detonator positioned on a detonator tube. The impact fuze in the tail assembly activates the detonator which breaks the case and scatters the chemical in burning particles and masses of varying sizes. (Figures 1, 2, 4; Test No. 1; Appendix "C".)

c. The sheet steel body of the T6E1 HC grenade is filled with the HC smoke composition. The impact fuze in the tail assembly activates an igniter which, in turn, starts the combustion of the HC compound of the filler. The compound burns progressively and generates a cloud of white smoke which escapes through holes provided for the purpose in the case. (Figures 1, 2 and 4; Test No. 1; Appendix "C".)

3. Factual Background: a. Army Ground Forces (Infantry) have long been on record as desiring that each type of high explosive projectile for all curved trajectory weapons of the Infantry be matched by a corresponding projectile loaded with W.P. (white phosphorus) having, as nearly as possible, the same trajectory and ballistics as the corresponding H.E. projectile. This requirement was based upon tests with other W.P. munitions, especially that for the 4.2" chemical mortar which indicated that, in addition to its screening effect as a smoke agent, the W.P. projectiles have a very satisfactory casualty producing effect against personnel both in the open and in foxholes and similar works without overhead cover. The specific effect of W.P. munitions in which it excels any type of high-explosive fragmentation shell is that against personnel in foxholes and open trenches. Against personnel so placed high explosive fragmentation has only a negligible effect except when a direct hit is obtained because the flat trajectory of the fragments cannot reach into the foxholes. The W.P. munition, on the other hand, throws out drops and masses of the burning chemical at low velocities, whose curved trajectory readily reaches targets located below ground in open pits of any nature, producing surface burns of varying extent and severity. This specific superiority of W.P. over H.E. was confirmed by tests conducted by The Infantry Board in the case of the W.P. shell (T6) for the 60mm mortar. (Report of The Infantry Board No. 1528) and of the Rocket, 2.36 W.P. T26. (Report of The Infantry Board No. 1546.) W.P. smoke shell, for the 81mm mortar (M57) with a trajectory nearly corresponding to that of the demolition shell (M56) for that weapon, has been standard for some time.

b. It was found by The Infantry Board in the case of the Rocket, 2.36" WP-T6, that when launched on relatively flat trajectories against small apertures in bunkers, pillboxes and similar covered emplacements W.P. projectiles produced an effect against personnel in the interior unequalled by any other means except a flame thrower. (Report, The Infantry Board No. 1546.)

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c. The previous tests above referred to and general experience have shown that, considered purely as a screening agent, white phosphorus is not as efficient as other, slow-burning compounds. This is due to the fact that a considerable portion of the smoke is carried upwards by convection currents produced by the heat of rapid combustion, and is lost for ground-screening purposes. This effect has caused to some extent the abandonment of W.P. as a screening agent in favor of other chemicals. These other chemicals, however, have no casualty effect and practically no morale effect upon personnel. It should be borne in mind, also, that this ineffectiveness of W.P. as a screening agent is only relative, and that it is still very effective for that purpose when properly used. (Reports of The Infantry Board No. 1528 and No. 1546.)

d. The subject smoke rifle grenades, constituting the companion-items of the antitank rifle grenade M9A1, the fragmentation rifle grenade M17, and the grenade-projection Adapter M1, will, if adopted, complete the program to place smoke munitions into the hands of all echelons of the Infantry.

4. Facts Determined by the Tests. The details of tests conducted by The Infantry Board are given in Tests Nos. 1 to 8, inclusive, annexed, and show:

a. That the subject rifle grenades (W.P. T5E1 and H.C. T6E1) are equal to each other in weight (1.5 lbs.), are intermediate in weight between the antitank grenade M9A1 (1.12 lbs.) and the Fragmentation Rifle Grenade M17 (1.75 lbs.), and are of substantially the same size and general shape as the M9A1 antitank grenade. (Test No.1.)

b. That both of the subject rifle grenades are properly designed for launching from the present standard grenade launchers. (all tests.)

c. That the fuze of both of the subject grenades functions reliably upon impact with solid ground at angles of incidence of twenty degrees or more. At lower angles and on softer surfaces the percentage of reliability is approximately as follows:

On solid ground, at less than 20° - 90% reliability.
On sand; at 30°, or more, 100% reliable; less than 30° - 80% reliable.
In water or very soft mud; Ineffective.

(Test No. 2)

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d. That both of the subject grenades function satisfactorily when thrown by hand if a streamer or other device is fastened to the tail assembly to produce a nose-on impact. (Test No. 2)

e. That both of the subject rifle grenades are superior in accuracy when launched from the same weapon, to the antitank rifle grenade M9A1. (Tests Nos. 3 and 4)

f. That the range obtained with each of the subject smoke rifle grenades with corresponding propelling charges and launcher-positions, is approximately eight percent (8%) less than that of the antitank grenade M9A1, and approximately fourteen percent (14%) greater than that of the fragmentation Rifle Grenade M17. (Test No. 3)

g. That the trajectories of both of the subject grenades can be made to coincide substantially at all ranges with the antitank rifle grenade M9A1 by the use of an extra auxiliary propelling charge of six grains of the type of powder now used in the standard auxiliary cartridges, enabling all three to be launched at the same target with the same firing data (Test No. 4).

h. That the subject Rifle Grenade WP T5E1 is greatly superior in casualty-producing effect against personnel in open trenches and foxholes to the antitank grenade M9A1, and is approximately equal to the latter in casualty-effect against unprotected personnel in the open. (Test No. 5; Figures 8 and 9.)

i. That the subject Rifle Grenade WP T5E1 is effective against personnel in the interior of bunkers, pillboxes and similar structures, when launched with flat trajectories against embrasures and openings. (Test No. 5)

j. That the subject Rifle Grenade HC T6E1 has no casualty producing effect but is superior to the subject WP T5E1 grenade for screening; both grenades produce effective screening smoke when properly masked. (Test No. 6; Figures 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, and 26.)

k. That the bursting charge of the subject rifle grenade, W.P. T5E1 is of the proper strength for maximum efficiency both in screening and in casualty production. (Test No. 7.)

l. That the subject rifle grenade W.P. T5E1 is moderately effective as an incendiary against readily inflammable materials. (Test No. 8.)

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5. Discussion. a. In looking for tactical uses to which munitions of this type can be put in infantry operations, four seem evident. They are:

(1) Local and short-range screening to blind hostile observation and reduce the effect of aimed hostile fire.

(2) Casualty production and morale effect on hostile personnel, supplementing fragmentation missiles.

(3) Use by friendly troops to conceal their own movements.

(4) Indicating targets to friendly supporting weapons and aircraft.

b. The presence in the hands of the foremost elements of the means for accomplishing any or all of the above can hardly fail to have important tactical results. At present they can be accomplished only to a very limited extent, so far as the smallest groups of the front line are concerned, with smoke munitions of the smoke-pot and hand-grenade type, but these are of such short range that they afford little flexibility. The ability to extend these means in any direction to a distance of several hundred yards from the location of the using personnel seems too obvious for discussion. The subject grenades appear to accomplish just that, and to place at the disposal of the individual rifleman and of the rifle squad a facility for which he has now to rely upon some rearward echelon.

c. As compared with each other, the two subject types of rifle grenades present a munition limited to one purpose for which it is highly efficient, as compared with a similar item which, while less efficient for that particular purpose, has important and decisive additional uses. One is purely defensive in its nature, while the other has both defensive and offensive uses. If a choice must be made between the two the one having a wider field of usefulness should certainly be chosen, and, in the light of the above findings of fact, the Rifle Grenade W.P. T5E1 appears to be the inevitable choice.

d. On the question of ballistics and usable range simplicity in use and training requires the avoidance of a multiplicity of different range tables. When front-line riflemen are confronted with an enemy position which they must reduce or neutralize it is highly desirable and much more effective to be able to launch projectiles of all similar types on the basis of data obtained with one. Due to a difference in weight, the subject grenades will not hit the same target with the same laying of the launcher as the corresponding fragmentation grenade. While elimination

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of this difference is not absolutely essential, it can certainly be said to be highly desirable.

6. Conclusions. The Infantry Board concludes:

a. That there is a requirement in the Infantry for a smoke producing rifle grenade corresponding generally to the high-explosive grenades now in use.

b. That there is also a requirement for a casualty-producing rifle grenade capable of reaching hostile personnel in open trenches and in bunkers and foxholes.

c. That the subject Rifle Grenade WP T5E1 is an effective and satisfactory munition for the accomplishment of both of the above purposes stated in a and b, above.

d. That the subject Rifle Grenade HC T6E1 is a satisfactory munition for screening in situations where neither casualty effect nor incendiary effect is desirable.

e. That it is desirable to increase the range of both of the subject rifle grenades by approximately eight percent (8%).

f. That it is desirable to issue the subject Rifle Grenade WP T5E1 to Infantry units with the present standard rifle grenades M9A1 and M17 as a complementary item, in a ratio of approximately one in three.

7. Recommendations. The Infantry Board recommends:

a. That the subject Rifle Grenade, W.P. T5E1 be adopted without delay for issue to Infantry troops along with the present standard Rifle Grenades M9A1 and M17, in the ratio of one of the former to two of the latter.

b. That the subject Rifle Grenade HC T6E1 be adopted for special issue on a basis to be determined by the commander of the theatre of operations.

c. That immediate consideration be given to the incorporation of an integral auxiliary propelling charge in both of the subject rifle grenades sufficient to make their ballistics substantially coincide with those of the antitank rifle grenade M9A1.

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d. That training literature be prepared and issued with the subject rifle grenade WP T5E1 outlining its employment substantially as indicated herein.

For the President:

INGOMAR M. OSETH,
Colonel, Infantry,
Director.

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REPORT of TEST

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RIFLE GRENADE, W.P., T5E1 AND H. C., T6

TEST SECTION
THE INFANTRY BOARD
FORT BENNING, GEORGIA

Submitted to
THE INFANTRY BOARD

Copy No. 2 Date 17 Feb 1944

1659 BENNING 8-16-43 1,000

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TEST SECTION
THE INFANTRY BOARD
FORT BENNING, GEORGIA

RESTRICTED

17 FEBRUARY 1944

SUBJECT: REPORT OF TEST OF RIFLE GRENADE, W.P., T5E1 AND H.C., T6

TO: THE PRESIDENT, THE INFANTRY BOARD, FORT BENNING, GEORGIA

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a b

a. Rifle grenade H.C. T6 and individual container.

b. Rifle grenade W.P., T5E1 and individual container.

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Figure 4

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1. Authority and References.

a. Authority.

(1) Memorandum, The Infantry Board, (IB-471.6) 28 January 1944 (See Appendix "A").

(2) Memorandum, The Infantry Board, (IB-471.6) 8 February 1944 (See Appendix "B").

(3) Letter, Office of the Chief of Ordnance, (O.O. No. 400.112/5147) 26 January 1944 with two Indorsements and six Inclosures. (See Appendix "C")

2. Introductory Information:

a. The Rifle Grenade W.P. T5E1 was developed as a WP Grenade companion to the rifle grenade M9A1 thereby rounding out the program of the Army Ground Forces (Infantry) to have a WP filled projectile for each HE filled projectile with corresponding ballistics.

b. The purposefor which WP filled projectiles are used are as follows:

(1) Casualty producing fire against personnel in the open, in trenches or in foxholes and therefore protected against fragmentation of H.E. Grenades.

(2) Incendiary and Antipersonnel fire against windows or other apertures of buildings, bunkers and other defensive structures.

(3) Screening or blinding smoke for use by front line elements in offensive action or other maneuver calling for interference with hostile observation or fire.

(4) Target designation by forward infantry elements in connection with fire direction of supporting Field Artillery, Infantry Cannon, Infantry Mortar, Aircraft, etc.

c. The Grenade, Rifle, Smoke, (WP) T5, except for a rib around the body, resembles the M9A1 AT Grenade and can be fired from any rifle or carbine using standard grenade launchers and cartridges. It is fuzed with an M9A1 modified fuze with a detonator (i.e. burster) which extends into the body of the grenade. The Modified fuze with a standard M9A1

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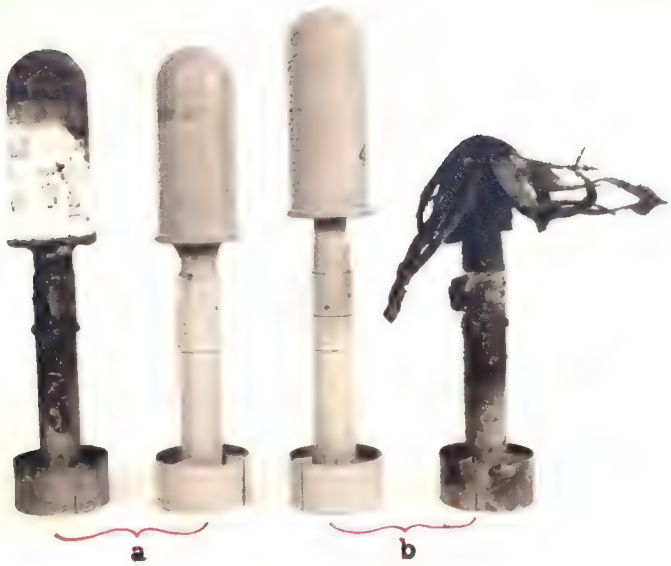

a. Rifle Grenade H.C., T6 - Before and after burning.

b. Rifle Grenade W.P., T5E1 - Before and after bursting.

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Figure 1

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DETAIL OF GRENADE W.P. T5E1

a. Grenade Head - W.P. filled.
b. Burster and adapter
c. Primer
d. Tail assembly - standard for impact rifle grenades.

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Figure 2

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3. Purpose of Test.

a. To determine:

(1) Grenade (WP) T5E1.

(a) Physical characteristics of grenade and packaging as compared to M9A1.

(b) Reliability of fuze of subject grenade on various types of ground when fired at various angles of elevation.

(c) Ballistic data as compared with other standard rifle grenades, especially Rifle Grenade M9A1 (A.T.) also stability in flight of this grenade.

(d) What, if any, Auxiliary propelling charge is required when using the rifle and carbine to cause the trajectory of the subject munition to coincide substantially with that of the M9A1 rifle grenade?

(e) The correctness of the bursting charge from the viewpoint of maximum effectiveness for:

1. Casualty effect against personnel in open, foxholes and the interior of bunkers or pillboxes.

2. As a screening agent, especially as to the duration and ground-hugging action of the smoke cloud.

(f) Effect of a smaller bursting charge on casualty effectiveness and screening ability of subject grenade.

(2) Grenade (HC) T6.

(a) Physical characteristics of grenade and packaging.

(b) Reliability of fuze of subject grenade on various types of ground when fired at various angles of elevation.

(c) Ballistic data as compared with other standard rifle grenades, also stability in flight.

(3) Comparison of the Grenade (WP) T5E1 and Grenade (HC) T6 as screening agents.

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4. Details of tests and results are as follows:

Test No. 1.

a. Purpose of Tests.

(1) To compare the physical characteristics of the subject grenades and standard types of HE grenades.

b. Method:

(1) By weighing, measuring and photographing.

c. Results:

(1) The assembled subject grenades have the same appearance as the A.T. Grenade M9A1 with the exception that they are painted the overall grey with yellow lettering characteristic of the Chemical Warfare Service and have a square base. The subject grenades also lack the rib around the middle of the grenade body.

(2) The grenade H.C. T6 is packed similarly to the A.T. Grenade M9A1. The grenade W.P. T5E1 is packed in a wood box slightly larger than that of the M9A1. The grenades are inclosed in a moisture proof package consisting of two corrugated paper boxes and two layers of paraffin coated gauze. The propelling cartridges in this package are placed under a false bottom inside the paper box. This accounts for the extra height of the box containing the WP Grenades.

(3) The following is a comparative tabulation:

Type of Grenade	M17	M9A1	T5E1	T6
Color	O D	O D	Grey	Grey
Type of filler	EC	TNT	WP	HC
Type of fuze	Impact	Impact	Impact	Impact
Number of grenades in box (wood)	10	10	10	10
Weight of box (10 grenades)	31.1#	29.75#	38.#	37.5#
Weight of grenades in individual containers	2.2#	1.8 #	2.1#	2.1#
Weight of grenade	1.75#	1.12#	1.5#	1.5#
Number of M3 Blanks with 10 grenades	11	11	10	10
Number of M6 Blanks with 10 grenades	0	0	6	6
Cubic displacement (Cu. Ft.) box of 10	.93	1.0	1.2	1.0

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(4) Packing instructions on the subject grenades listed an additional box of five auxiliary grenade cartridges M7. None of the boxes of grenades tested contained these cartridges. (See figure 3 and figure 4.)

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a. Wood box containing 10 grenades H.C., T6 and Individual container for each grenade.

b. Wood box containing 10 grenades W.P., T5E. and Individual container for each grenade.

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Figure 3

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Test No. 2.

Ground conditions - Water - 3' deep
Water - 6" deep over mud
Water - 6" deep over solid earth
Soft mud
Fresh earth
Sand
Solid ground

a. Purpose of test.

(1) To determine the reliability of the fuze of the subject grenades when fired into various types of ground conditions from various angles of elevation.

(2) To determine the reliability of the fuze of the subject grenades when fired into trees and when thrown by hand.

b. Method:

(1) Five of each of the subject grenades were fired into each of seven types of ground at various angles and the fuze action noted.

(2) Five of each of the subject grenades were fired into large trees and the fuze action noted.

(3) Five of each of the subject grenades were thrown by hand with and without a stabilizing streamer and the fuze action noted.

c. Results:

(1) The fuzes of the subject grenades will not function on impact with water, shallow water and mud or in soft mud.

(2) The fuzes of the subject grenades fired into shallow water (6") over solid ground operated when fired at high angles. It was noted however that the grenade HC T6 was not ignited and the grenade WP T5E1 burned only the WP that was blown above the water.

(3) The fuzes of all subject grenades fired into freshly turned earth operated. However the grenades HC T6 were smothered by the loose earth that covered the grenade. The grenade WP T5E1 was not smothered due to its bursting action. (See Figure 5.)

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(4) The fuses of all the subject grenades fired into sand operated when the angle of incidence was 30° or greater. At angles of impact less than 30° the subject grenades were not retarded sufficiently to operate the fuse in all cases. At angles of impact less than 30°, 20% of the fuses failed to operate on the first attempt. All fuses operated within three attempts at the same angle of impact.

(5) The fuses of all the subject grenades fired at solid ground operated when the angle of incidence was 20° or greater. At angles of impact less than 20° the fuses of approximately 10% of the subject grenades failed to operate. All fuses operated within 3 attempts at the same angle of impact. (See Figure 6.)

(6) The fuses of all grenades that struck solid limbs when fired into trees operated satisfactorily. (See Figure 7.)

(7) The subject grenades must land on the nose to operate the fuse. Hand thrown grenades must be stabilized by a rope or rag tied to the tail fins. All grenades thrown with a stabilizer streamer attached operated. Only the few that hit on the nose operated when a streamer was not used.

(8) All grenades W.P., T5E1 operated satisfactorily when the fuse was detonated. Seventy-five per cent of the grenades H.C., T6 that ricocheted on the ground or in the trees and struck with sufficient force to ignite the fuse and the starting mixture failed to ignite the filler.

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Maximum smoke from H.C. grenade fired into fresh earth.

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Figure 5

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Burst of Grenade W.P. T5E1 fired at low angle.

Grenade fired was moving across the front of the camera from the left. Note forward projection of W.P. particles.

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Figure 6

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Burst of Grenade W.P., T5E1 in trees.

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Figure 7

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Test No. 3.

Hour and date - 0900 2 February 1944
Wind - 5 mph at 9 o'clock
Temperature - 60°F.
Weather - Clear
Weapon - M1 Rifle, M7 launcher, M3 cartridge, M7 Auxiliary cartridge. Rifle Rest.

a. Purpose of test.

(1) To compare the ballistics of the subject grenades with that of the HE Grenades M17 and M9A1.

(2) To observe the stability of flight of the subject grenades.

b. Method:

(1) By firing 3 grenades of each type at each launcher ring with constant elevation of 45° and measuring the average range of each group.

Firing was done from rifle rest. Stability of flight was observed during the firing.

c. Results:

(1) The following is a tabulation of range obtained in the projecting of the grenades:

Angle of Elevation — 45°

Launcher Ring	Range in yards M17	M9A1	T5E1	T6
6	46	53	49	49
5	51	65	57	57
4	69	91	80	80
3	109	137	125	122
2	135	168	154	154
1	160	198	183	185
Full	175	216	200	200
Full and 20 Gr. Auxiliary Cart.	256	295	280	281

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(2) In all cases the stability in flight of the grenades T5E1 and T6 is much better than that of the M9A1.

The stability of all grenades fired from ring 6 was unsatisfactory. All grenades fired with this setting tumbled in the air and 10% failed to ignite due to the angle at which it struck.

The impact areas of the grenades M17, T5E1 and T6 were smaller than that of the M9A1. The dispersion of the M9A1 grenade averages were double that of the other three grenades at the same range.

Note: The ranges obtained with all grenades in this test are less than those normally obtainable, which may be attributable to the fact that the propelling blanks were cold.

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Test No. 4.

Hour and date - 1400-10 February 1944
Wind - 5 mph at 11 o'clock
Temperature - 75°F.
Weather - Clear
Weapon - M1 Rifle with M7 launcher, M3 cartridge, Auxiliary cartridges loaded as follows:
5 gr, 6 gr, 7 gr, 8 gr, and 9 gr. Made from auxiliary cartridges M7 (20 gr.)
Grenades M9A1, T5E1, T6.
Rifle Rest.

a. Purpose of Test.

(1) To determine what auxiliary propelling charge is necessary to make the trajectory of the subject grenades conform substantially to that of the M9A1 Grenade.

b. Method:

Grenades M9A1 were fired at the full position on the launcher from an M1 rifle mounted in a rifle rest. Five grenades were fired at various angles of elevation using the M3 cartridge. With the same angle of elevation 5 grenades T5E1 and T6 were fired with auxiliary propelling charges of 5, 6, 7 and 8 grains. Impact areas were inspected and results recorded.

c. Results:

(1) Six grains of powder in the auxiliary propelling charge gives the necessary change in trajectory to the T5E1 and T6 grenades to conform substantially to that of the M9A1 grenade.

(2) In all cases projecting the subject grenade resulted in smaller impact areas than with the M9A1 grenade.

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Test No. 5.

Ground condition - wet.
Wind - 5 mph.
Weapon - M1 Rifle, M7 launcher, rifle rest,
Grenades - W.P., T5E1 and A.T. M9A1.

a. Purpose of Test.

(1) To compare the casualty effect of the WP T5E1 grenade and A.T. M9A1 grenade against personnel in the open and in foxholes.

(2) To determine the casualty effect of the WP T5E1 grenade on personnel in bunkers or pillboxes.

b. Method:

(1) An area was prepared having 36 standard foxholes on 5 yard centers. Fatigue clothes were stuffed with grass and placed in the holes allowing 20" clearance below the ground level.

(2) 25 double kneeling three-dimensional silhouettes were placed in the same area between the foxholes to represent personnel in the open.

(3) 5 rounds each of grenades T5E1 and M9A1 were distributed over this area and casualty producing hits recorded.

(4) Silhouettes were placed in pillboxes constructed from plans of Japanese emplacements. W.P. T5E1 grenades were fired at the embrasure from 50 and 75 yards. The results were noted.

c. Results.

(1) The results of the casualty test is tabulated below:

Type of Grenade	A. T. M9A1	WP T5E1
Number of grenades fired	5	5
Number of dummies in foxholes	36	36
Number of double silhouettes	25	25
Number of dummies hit	0	12
Number of silhouettes hit	15	13
Total hits	15	25

For casualty effect of WP Grenade see figures 8 and 9.

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(2) Grenades striking above or on the side of the embrasure screened visibility and filled the interior of the bunker with fumes when the wind was favorable. Grenades striking the embrasure or within 6 feet and on line with the opening project some WP into the embrasure, causing burns on the occupants inside as well as causing a dense cloud of irritant smoke within the bunker.

Five shots were fired at the embrasure from 50 and 75 yards. In 3 cases where grenades struck in front of the embrasure the WP was thrown into the bunker causing some casualties. Three silhouettes facing the embrasure were hit each time. (See figures 10, 11, 12 and 13.)

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Casualty effect of Grenade W.P. T5E1 on troops in open. Point of burst 6 feet from silhouette.

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Figure 8

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Casualty effect of Grenade W.P., T5E1 on troops in foxholes. Point of burst 4 feet from silhouette.

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Figure 9

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Burst of WP Grenade striking 3 feet in front of bunker aperture.

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Figure 10

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Smoke billowing from bunker hit by W.P. Grenade 30 seconds after burst.

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Figure 11

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Smoke flowing from interior of bunker 3 minutes after burst of WP Grenade..

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Figure 12

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Burst of WP Grenade left of aperture. Note forward spray of WP.

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Figure 13

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Test No. 6.

Hour and Date 1000 - 7 February 1944
Ground - Wet.
Wind - 5 mph at 3 o'clock.

a. Purpose of Test.

(1) To compare the burning time and screening capabilities of the subject grenades.

b. Method:

(1) By observing and photographing individual bursts and concentrations.

(2) By timing the effective screening period of each type of subject grenade separately and in concentrations.

c. Results:

(1) (a) The grenade WP T5E1 bursts instantaneously on impact. (See figures 14, 15 and 16.)

(b) The grenade HC, T6 ignites on impact and burns. The average burning time of 5 grenades T6 was 1 minute and 13 seconds from impact. (See figures 17, 18 and 19.)

(2) (a) The grenade WP, T5E1 bursts on impact and distributes WP over an area approximately 15 yards in radius. Of this area 7 yards from the point of impact can be considered 100% casualty producing.

(b) Due to the heat of the W.P. the smoke cloud from a single grenade rises and loses most of its screening effect in 25 seconds from time of impact. (See Fig. 15, page 37 and Fig. 16, page 38 .)

(3) The grenade HC T6 does not burst on impact. It is a base emission type smoke grenade and has no casualty producing effect. This grenade requires 15 seconds from time of impact to generate a smoke cloudand smokes with increasing volume for one minute and 13 seconds. The smoke cloud remains a fair screen for 1/2 minute after the grenade burns out. In soft ground this grenade sticks in the ground and throws the smoke into the air. This sometimes leaves a gap in the screen close to the grenade.

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(4) The grenade WP T5E1 is much better for instantaneous smoke due to its bursting upon impact. 10 grenades fired from one rifle in 45 seconds produced an effective screen instantaneously and was effective for one minute after the last grenade burst. The burst of several grenades in one area breaks down the tendency of the smoke pillar and makes the smoke hang close to the ground. (See figures 20, 21, 22 and 23, pages 43 to 46 inclusive.)

(5) The grenade HC T6 is a better screening agent due to the length of burning time and volume of smoke developed. Ten grenades fired from one rifle in 52 seconds produced an effective smoke screen in 20 seconds and was effective for 2 minutes after the last grenade ignited. The HC smoke hangs close to the ground due to its weight. (See figures 24, 25 and 26, pages 47 to 49 inclusive.)

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Burst of W.P. Grenade

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Figure 14

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Smoke cloud from single W.P. Grenade 15 seconds after burst.

Note pillaring of smoke.

Note dispersion of W.P. on ground.

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Figure 15

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Smoke cloud from single W^P Grenade 25 seconds after burst.

Note separation of main cloud from ground.

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Figure 16

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Smoke cloud from single HC grenade 5 seconds after impact.

Note starting charge has just ignited HC and small amount of dense smoke is flowing.

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Figure 17

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Smoke cloud from single HC grenade 30 seconds after impact.

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Figure 18

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Smoke cloud from one H.C. grenade 1-1/4 minute after impact (final discharge of smoke).

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Figure 19

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Smoke cloud formed by 5 grenades W.P. T5E1 at burst of 5th grenade.

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Figure 20

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Smoke cloud formed by 10 grenades W.P. T5E1 at burst of 10th grenade.

Figure 21

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Smoke cloud formed by 10 grenades W.P. T5E1
30 seconds after burst of last grenade.

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Figure 22

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Smoke cloud formed by 10 grenades, W.P., T5E1 1 minute after burst of last grenade.

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Figure 23

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Smoke cloud formed by 5 grenades H.C., T6 at impact of 5th grenade.

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Figure 24

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Smoke cloud formed by 10 grenades, H.C., T6 at impact of 10th grenade.

Figure 25

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Smoke cloud formed by 10 grenades, H.C., T6 one minute after impact of last grenade.

Figure 26

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Test No. 7.

Time and date - 0930, 7 February 1944
Ground conditions - wet.
Wind velocity - 5 mph.

a. Purpose of test:

To determine the effect of reducing the bursting charge in the grenade, W.P., T5E1.

b. Method:

The No. 8 cap in 3 grenades was replaced by a No. 6 cap by local ordnance personnel. These grenades were compared in effect with the grenade T5E1 having the normal bursting charge.

c. Results:

(1) Grenade head was partially ruptured giving poor dispersion and therefore poor casualty producing qualities.

(2) The low burst formed a pool of WP that produced an effective smoke screen for 2 minutes and maintained a light screen for an additional 1-1/2 minutes.

(3) The density of this smoke was not comparable to that of the grenade RC, T6.

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Test No. 8.

Weather - clear and cool.
Wind - 5 mph.

a. Purpose of Test.

To determine the incendiary effect of the grenade WP, T5E1 on wood and on gasoline.

b. Method:

(1) Two grenades WP T5E1 were fired into a number of ammunition packing cases and crates and the results noted.

(2) Two grenades WP T5E1 were fired at a standard gasoline can and the results noted.

c. Results:

(1) The wood was not ignited by the grenades.

(2) The gasoline container was ignited by the grenades. The velocity of the grenade tail assembly drove the burster tube into the gasoline container causing a leak. The second grenade was also driven into the gasoline container causing leakage and ignition of the fuel. (See figure 27, page 52.)

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a. Point where first W.P. grenade penetrated gasoline can.

b. Point where second W.P. grenade penetrated gasoline can.

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Figure 27

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5. Summary of Facts determined by Tests.

a. The foregoing tests disclosed the following facts:

(1) The subject grenades weigh .38# more than the Grenade (A.T.) M9A1 and .25# less than the grenade fragmentation M17. (See Test No. 1.)

(2) The fuzes of the subject grenades will not function when fired into water or soft mud. (Test No. 2.)

(3) The fuzes of the subject grenades operated when fired into fresh earth but the grenade H.C. T6 buried itself and was smothered by the soft earth. (Test No. 2.)

(4) In sand the fuzes of the grenades are 100% dependable when angle of impact is greater than 30° and 80% dependable when angle of impact is less than 30°. (Test No. 2.)

(5) On hard ground the fuzes of the grenades are 100% dependable when the angle of impact is greater than 20° and 90% dependable when the angle of impact is less than 20°. (Test No. 2.)

(6) Fuzes of grenades are operated by solid impact with tree limbs or trunks. (Test No. 2.)

(7) The subject grenades can be successfully thrown by hand if a stabilizing streamer is attached to the tail fins. (Test No. 2.)

(8) The grenade HC T6 is only 25% dependable on ricochet impact. (Test No. 2.)

(9) The range of the subject grenades is less than that of the grenade A.T. M9A1 and greater than that of the grenade fragmentation M17 when fired with the cartridge M3. (Test No. 3.)

(10) The stability in flight of the subject grenades is better than that of the grenade M9A1. (Test No. 3.)

(11) The dispersion of the subject grenades is less than that of the grenade M9A1. (Test No. 3.)

(12) An auxiliary 6-grain cartridge will make the trajectory of the subject grenades conform substantially to that of the grenade M9A1. (Test No. 4.)

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(13) The grenade W.P. T5E1 compares favorably with the grenade A.T. M9A1 in casualty producing effect against troops in the open. (Test No. 5.)

(14) The grenade W.P. T5E1 is as effective on troops in foxholes as it is on troops in the open, while the grenade A.T. M9A1 is not effective on troops entrenched. (Test No. 5.)

(15) The grenade W.P. T5E1 is an effective blinding agent against bunkers. Hits must be made in or in front of embrasures to produce casualties within the bunker. (Test No. 5.)

(16) The grenade W.P. T5E1 forms a smoke cloud instantaneously on impact and lasts for about 25 seconds while the grenade HC T6 burns for about 1 minute and 13 seconds and produces a screening cloud from 15 seconds after impact until 1/2 minute after the grenade burns out. (Test No. 6.)

(17) The smoke from grenade W.P. T5E1 when fired individually pillars and leaves the ground. Several grenades, fired in concentration, break down convection currents and produce a good smoke cloud. (Test No. 6.)

(18) The grenade HC T6 when fired individually gives a good smoke screen and when fired in concentrations maintains an excellent screen for 2 minutes after the last grenade is ignited. (Test No. 6.)

(19) The grenade WP T5E1 has an average bursting radius of 15 yards and has a 100% effective casualty producing radius of 7 yards. (Test No. 6.)

(20) By reducing the burster charge of the grenade WP T5E1 the casualty producing effect is diminished and the screening effect is prolonged to 3-1/2 minutes. (Test No. 7.)

(21) The grenade W.P. T5E1 is not a good incendiary on wood. (Test No. 8.)

(22) WP grenades fired at a gasoline container penetrated the container and ignited the contents. (Test No. 8.)

6. Test Officer's Discussion.

a. It is the opinion of the Test Officer that the rifle grenade W.P. T5E1 is the most satisfactory of the two subject grenades for the following reasons:

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(1) In carrying this grenade the soldier will not sacrifice casualty producing grenades for smoke alone.

(2) The WP grenade adds further use to the casualty producing grenade in that it will reach the men in emplacements and foxholes.

(3) The WP grenade places a good screening agent in the basic unit, the squad.

(4) The WP grenade is more satisfactory than the HC grenade due to its bursting qualities.

WILLIAM S. SINCLAIR, JR.,
Captain, Infantry,
Test Officer.

I concur in the above report:

WILLIAM C. RUTHERFORD,
Lt. Colonel, Infantry,
Chief of Test Section.

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